CLAIMS:

1. An apparatus for reading information from an information carrier (11) having tracks (9), comprising

a radiation source for generating a main beam (31) and two satellite beams (30,32),

objective means for directing the main beam (31) to a main track and the two satellite beams (30,32) to locations adjacent to the main track,

detection means for converting a reflection of the main beam (31) from the information carrier (11) to a read signal (C) which contains information of the main track, and for converting reflected satellite beams to satellite signals (S^+,S^-) containing information of tracks adjacent to the main track,

cross-talk removing means (28) for outputting an improved read signal ($\widetilde{C}$), comprising a first circuit for suppressing cross-talk of the adjacent tracks present in the read signal (C),

characterized in that the cross-talk removing means (28) further comprise a second circuit for outputting improved satellite signals ($\widetilde{S}^+, \widetilde{S}^-$) by suppressing cross-talk of the main track present in the satellite signals (S^+,S^-) by minimizing a correlation between the satellite signals (S^+,S^-) and the read signal (C), the improved satellite signals ($\widetilde{S}^+, \widetilde{S}^-$) being subsequently fed to the first circuit which is arranged to suppress the cross-talk of the read signal (C) by minimizing a correlation between the improved read signal ($\widetilde{C}$) and the improved satellite signals ($\widetilde{S}^+, \widetilde{S}^-$).

2. An apparatus as claimed in claim 1, wherein the satellite beams (30,32) are directed to a position halfway between the main track and the adjacent tracks.

3. An apparatus as claimed in claim 1, wherein the satellite beams (30,32) are directed towards the adjacent tracks.

4. An apparatus as claimed in one of the previous claims, wherein the first circuit comprises

a first variable filter (46) for filtering a first improved satellite signal ($\tilde{S}^+$), the filter having at least one adjustable coefficient,

a second variable filter (47) for filtering a second improved satellite signal ($\tilde{S}^-$), the filter having at least one adjustable coefficient,

a first subtractor (50) for subtracting the filtered improved satellite signals ($\tilde{S}^+, \tilde{S}^-$) from the read signal (C) and outputting the improved read signal ($\tilde{C}$),

a first coefficient control device (48) for minimizing a correlation between the first improved satellite signal ($\tilde{S}^+$) and the improved read signal ($\tilde{C}$) by controlling the adjustable coefficient of the first variable filter (46),

a second coefficient control device (49) for minimizing a correlation between the second improved satellite signal ($\tilde{S}^-$) and the improved read signal ($\tilde{C}$) by controlling the adjustable coefficient of the second variable filter (47).

5. An apparatus as claimed in one of the previous claims, wherein the second circuit comprises

a third variable filter (40) for filtering the read signal (C) and outputting a first filtered read signal, the filter having at least one adjustable coefficient,

a second subtractor (42) for subtracting the first filtered read signal from the first satellite signal (S^+) and outputting the first improved satellite signal ($\tilde{S}^+$),

a third coefficient control device (44) for minimizing a correlation between the first improved satellite signal ($\tilde{S}^+$) and the read signal (C) by controlling the adjustable coefficient of the third variable filter (40),

a fourth variable filter (41) for filtering the read signal (C) and outputting a second filtered read signal, the filter having at least one adjustable coefficient,

a third subtractor (43) for subtracting the second filtered read signal from the second satellite signal and outputting the second improved satellite signal ($\tilde{S}^-$), and

a fourth coefficient control device (45) for minimizing a correlation between the second improved satellite signal ($\tilde{S}^-$) and the read signal by controlling the adjustable coefficient of the fourth variable filter (41).

6. An apparatus as claimed in claim 4, wherein the first coefficient control device (48) is arranged to minimize the correlation between the improved read signal ($\widetilde{C}$) and the first improved satellite signal ($\widetilde{S}^+$) by minimizing the cost function:

$$J(f_k^+) = (\widetilde{C}\widetilde{S}^+)^2$$

wherein J is the cost function, f_k^+ is the at least one adjustable coefficient of the first variable filter (46), $\widetilde{C}$ is the improved read signal, $\widetilde{S}^+$ is the first improved satellite signal

and wherein the second coefficient control device is arranged to minimize the correlation between the improved read signal ($\widetilde{C}$) and the second improved satellite signal ($\widetilde{S}^-$) by minimizing the cost function:

$$J(f_k^-) = (\widetilde{C}\widetilde{S}^-)^2$$

wherein f_k^- is the at least one adjustable coefficient of the second variable filter, and $\widetilde{S}^-$ is the second improved satellite signal.

7. An apparatus as claimed in claim 5, wherein the third coefficient control device (44) is arranged to minimize the correlation between the first satellite signal (S^+) and the read signal (C) by minimizing the cost function:

$$J_S(g_k^+) = (C\widetilde{S}^+)^2$$

wherein J_S is the cost function, g_k^+ is the at least one adjustable coefficient of the third variable filter (40), C is the read signal, $\widetilde{S}^+$ is the first improved satellite signal and wherein the fourth coefficient control device (45) is arranged to minimize the correlation between the second satellite signal (S^-) and the read signal by minimizing the cost function:

$$J_S(g_k^-) = (C\widetilde{S}^-)^2$$

wherein g_k^- is the at least one adjustable coefficient of the fourth variable filter (41) and $\widetilde{S}^-$ is the second improved satellite signal.

8. An apparatus as claimed in claim 1, wherein the improved read signal ($\widetilde{C}$) is fed back to the second circuit and wherein the first circuit is arranged to suppress cross-talk of the main track present in the satellite signals (S^+,S^-) by minimizing a correlation between the improved satellite signals ($\widetilde{S}^+, \widetilde{S}^-$) and the improved read signal ($\widetilde{C}$).

9. A method for reading information from an information carrier (11) having tracks (9), comprising the steps of

generating a main beam (31) and two satellite beams (30,32),

directing the main beam (30) to a main track and the two satellite beams (30,32) to locations adjacent to the main track,

converting a reflection of the main beam (31) from the information carrier (11) to a read signal (C) which contains information of the main track, and converting reflected satellite beams to satellite signals (S^+,S^-) containing information of tracks adjacent to the main track,

outputting an improved read signal ($\widetilde{C}$) which is derived from the read signal (C) by suppressing cross-talk of the adjacent tracks present in the read signal (C),

characterized in that the method further comprises the step of outputting improved satellite signals ($\widetilde{S}^+, \widetilde{S}^-$) by suppressing cross-talk of the main track present in the satellite signals (S^+,S^-) by minimizing a correlation between the satellite signals (S^+,S^-) and the read signal (C), and wherein the step of outputting an improved read signal ($\widetilde{C}$) suppresses cross-talk of the adjacent tracks present in the read signal (C) by minimizing a correlation between the improved read signal ($\widetilde{C}$) and the improved satellite signals ($\widetilde{S}^+, \widetilde{S}^-$).

10. Method as claimed in claim 9, wherein the satellite beams (30,32) are directed to a position halfway between the main track and the adjacent tracks.

11. Method as claimed in claim 9, wherein the satellite beams (30,32) are directed towards the adjacent tracks.

12. Method as claimed in one of the claims 9 to 11, wherein the step of outputting an improved read signal ($\widetilde{C}$) comprises the substeps of

a) filtering a first improved satellite signal ($\widetilde{S}^+$) with a first variable filter (46) having at least one adjustable coefficient,

b) filtering a second improved satellite signal ($\widetilde{S}^-$) with a second variable filter (47) having at least one adjustable coefficient,

c) outputting the improved read signal ($\widetilde{C}$) by subtracting the filtered improved satellite signals from the read signal (C),

d) minimizing a correlation between the first improved satellite signal ($\widetilde{S}^+$) and the improved read signal ($\widetilde{C}$) by controlling the adjustable coefficient of the first variable filter (46),

e) minimizing a correlation between the second improved satellite signal ($\widetilde{S}^-$) and the improved read signal ($\widetilde{C}$) by controlling the adjustable coefficient of the second variable filter (47),

f) outputting a first filtered read signal by filtering the read signal (C) with a third variable filter (40) having at least one variable coefficient,

g) outputting the first improved satellite signal ($\widetilde{S}^+$) by subtracting the first filtered read signal from the first satellite signal (S^+),

h) minimizing a correlation between the first improved satellite signal ($\widetilde{S}^+$) and the read signal by controlling the adjustable coefficient of the third variable filter (40),

i) outputting a second filtered read signal by filtering the read signal (C) with a fourth variable filter (41) having at least one variable coefficient,

j) outputting the second improved satellite signal ($\widetilde{S}^-$) by subtracting the second filtered read signal from the second satellite signal (S^-), and

k) minimizing a correlation between the second improved satellite signal ($\widetilde{S}^-$) and the read signal (C) by controlling the adjustable coefficient of the fourth variable filter (41).

13. A method as claimed in claim 11 or 12, wherein substep d minimizes the correlation by minimizing the cost function:

$$J(f_k^+) = (\widetilde{C}\widetilde{S}^+)^2$$

wherein J is the cost function, f_k^+ is the at least one adjustable coefficient of the first variable filter (46), $\widetilde{C}$ is the improved read signal, $\widetilde{S}^+$ is the first improved satellite signal

and wherein substep e minimizes the correlation by minimizing the cost function:

$$J(f_k^-) = (\widetilde{C}\widetilde{S}^-)^2$$

wherein f_k^- is the at least one adjustable coefficient of the second variable filter (47),

and $\tilde{S}^-$ is the second improved satellite signal.

14. A method as claimed in claim 11, 12 or 13, wherein the substep h minimizes the correlation by minimizing the cost function:

$$J_S(g_k^+) = (C\tilde{S}^+)^2$$

wherein g_k^+ is the at least one adjustable coefficient of the third variable filter (40), and $\tilde{S}^+$ is the first improved satellite signal, and wherein substep k minimizes the correlation by minimizing the cost function:

$$J_S(g_k^-) = (C\tilde{S}^-)^2$$

wherein g_k^- is the at least one adjustable coefficient of the fourth variable filter (41), and $\tilde{S}^-$ is the second improved satellite signal.

15. Method as claimed in claim 9, wherein the step of outputting the improved satellite signals ($\tilde{S}^+, \tilde{S}^-$) improves the satellite signals (S^+,S^-) by suppressing cross-talk of the main track present in the satellite signals (S^+,S^-) by minimizing a correlation between the improved satellite signals ($\tilde{S}^+, \tilde{S}^-$) and the improved read signal ($\tilde{C}$).